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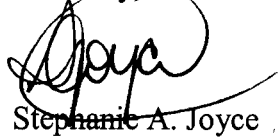
Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: Reply Comments, *Allocations and Service Rules for the 71-76GHz, 81-86
Ghz and 92-95 GHz Bands; Loea Communications Corporation Petition
for Rulemaking.* WT Docket No 02-146, RM-10288

Dear Ms. Dortch:

Attached for filing are the Reply Comments of Loea Communications Corporation ("Loea") in the above-captioned dockets. Please do not hesitate to contact me with any questions or concerns regarding this filing: 202.955.9890.

Sincerely,



Stephanie A. Joyce

Counsel for Loea Communications Corporation

cc: Service List

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Allocations and Service Rules for the 71-76 GHz, 81-86 GHz, and 92-95 GHz Bands)	WT Docket No. 02-146
)	
Loea Communications Corporation Petition)	RM-10288
For Rulemaking)	

REPLY COMMENTS OF LOEA COMMUNICATIONS CORPORATION

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Dated: February 3, 2003

SUMMARY

The spectrum at 71-76GHz and 81-86GHz has the potential to increase substantially the availability and capacity of broadband services for American consumers. To ensure this result, the Commission should adopt licensing and service rules that permit easy and low-cost access to this spectrum by an entity or individual, while allowing for flexible and efficient deployment and use. Loea believes, and the record strongly demonstrates, that a system of blanket nationwide licenses, coupled with individual site path authorization, is the licensing framework best suited to achieving wireless broadband services at 71-76 GHz and 81-86 GHz.

Blanket licensing with path coordination will provide the security of investment that the prevailing financial climate demands. This framework, which is commensurate with the Commission's policy to minimize regulatory intrusion on telecommunications development, will also encourage new entry and innovative deployment, both today and in the future. Moreover, the blanket licenselcoordinated path approach maximizes the value of the spectrum for consumers, which remains at the forefkont of Congressional and Commission policy.¹

In keeping with this flexible, pro-consumer approach, the Commission should apply broad license eligibility requirements for the UMW spectrum, and should grant licenses for the full 10-year term with a consumer-focused renewal threshold. Today's financial markets demand that as many interested parties as possible be permitted to develop and employ

¹ *See* Remarks of Chairman Michael K. Powell at the Silicon Flatirons Telecommunications Program, University of Colorado at Boulder, "Broadband Migration III: New Directions in Wireless Policy" (Oct. 30, 2002) ("Powell Remarks") ("Such a policy must embody what we have seen benefit the public in every other area of consumer goods and services – choice through competition, and limited, but necessary, government intervention into the marketplace to protect such interests as access to people with disabilities, public health, safety and welfare.").

commercial spectrum. Thus, license eligibility should be constrained only by the foreign ownership limits defined by Congress in Section 310.²

License terms should be the customary 10 years, with renewal based on the licensee's provision of "sound, favorable" substantial service to consumers.³ This threshold for renewal expectancy places the focus correctly on the value provided to end users, in keeping with the Commission's commitment to administering spectrum for the public good.

Most technical issues in this proceeding have garnered a consensus of opinion within the industry. For example, the record is unanimous that this spectrum should not be channelized. In many instances, where commenters initially disagreed, most notably with respect to power and antenna gain parameters for UMW technology, these parties, which include the Over 40 GHz Committee of the WCA, members of the WCA, and Cisco, have met to eliminate or narrow any differences. In these Reply Comments, Loea discusses the areas of consensus reached by Loea, Cisco, Ceragon Networks, Endwave Corporation, Stratex Networks, Bridgewave, and Comsearch. These agreements are more fully explicated in the attached Supplemental Paper of Dr. John Lovberg. Loea believes that these modified technical proposals will best ensure that the spectrum is licensed and used on a flexible, low-cost, and non-interfering basis. Where consensus has not been reached, Loea adheres to its positions on technical issues as filed in its Initial Comments — or as refined herein — while assuring the Commission that it will endeavor to work with all commenters to come to an accord on those issues.

² 47 U.S.C. § 310(a)-(b).

³ 47 C.F.R. § 101.1011.

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Loea Communications Corporation Petition For Rulemaking)	RM-10288
)	

REPLY COMMENTS OF LOEA COMMUNICATIONS CORPORATION

Loea Communications Corporation (“Loea”), by its attorneys, provides these reply comments in response to the Notice of Proposed Rulemaking issued in the above-captioned docket.⁴ Loea’s focus remains the rapid and efficient deployment of the 71-76 GHz and 81-86 GHz spectrum, which is collectively referred to herein as the “Upper Millimeter Wave” or “UMW” spectrum.⁵ In support of these comments, the following is respectfully shown:

I. INTRODUCTION

From the outset of the Commission’s examination of the UMW spectrum, there has been a remarkable consensus among commenters on the value of this spectrum for the delivery of broadband services, the need for the Commission to act expeditiously to open these bands to service providers, and the importance of issuing blanket nationwide licenses, subject to path coordination, without auctions.⁶ This consensus is demonstrated again in the initial comments

⁴ *Allocation and Service Rules for the 71-76GHz, 81-86GHz and 92-95 GHz Bands; Loea Communications Corporation Petition for Rulemaking*, WT Docket No. 02-146, Notice of Proposed Rulemaking, FCC 02-180, 17 FCC 12182(2002)(“*NPRM*”).

⁵ The 71-76 GHz and 81-86 GHz spectrum is the subject the Loea’s above-referenced Petition for Rulemaking, which was filed at the Commission on September 10, 2001 (“Loea Petition”).

⁶ The site-based licensing approach is also supported by the National Telecommunications and Information Administration as stated in January 13, 2003 letter from Michael D.

filed in this proceeding. There also has been a convergence of opinion on technical issues, and Loea, Cisco, Endwave, and many other companies (including members of the Over 40 GHz Committee) have met over the past month to further this convergence.⁷ Additional areas of agreement of these parties is reflected herein. Loea submits that there is both a need to complete this proceeding as soon as possible and – with only a limited set of open issues remaining – the ability to do so. Loea remains committed to working with the Commission, the Federal Government user community, and the private sector toward this end.

The commenters in this proceeding agree that opening up the UMW spectrum will create a leading solution for the delivery of multi-gigabit services (including OC-48, OC-192 and 10 Gig E), particularly in high-cost areas.⁸ To bring this spectrum into service, the commenters urge the Commission to adopt licensing and service rules that best ensure the most expeditious and flexible use of this spectrum.’ The overwhelming majority of commenters support the proposed band plans for the 71 GHz and 81 GHz bands, and favor site-based (as opposed to geographic) licensing, without auctions. Loea, Cisco, and others believe that the best way to implement this site-based scheme is through streamlined blanket licensing and path coordination by an independent third-party clearinghouse.

Gallagher, Deputy Assistant Secretary for Communications and Information to **Mr. Louis S. Slaughter**, President and CEO of Loea (“Gallagher Letter”) (see Attachment 2). In this letter, Mr. Gallagher states that “NTIA generally supports full sharing of these bands with commercial users using site licensing and coordination.”

⁷ Additional areas of agreement of these parties is reflected herein.

⁸ WT Docket No. 02-146, Comments of The Boeing Company at 2; Comments of Cisco Systems, Inc. at 1-6; Letter of Jeffrey Anderson, EDS, to Marlene H. Dortch, Secretary, FCC; Comments of Endwave Corporation at 3; Comments of Harris Corporation at 1, 3; Letter of Richard Burkhart, CEO, i-Fi, LLC/BGI, Inc. to Marlene H. Dortch, Secretary, FCC; Loea Communications Corporation at i, 1-5; Comments of Sprint Corporation at 2-3; Comments of Terabeam Corporation at 1-2; Comments of Wireless Communications Association International, Inc. (WCA) at 2-4.

⁹ *See* Boeing at **6**; Cisco at 1, **6**; Comsearch at 2; **EDS** Letter; Endwave at 5; Comments of the Fixed Wireless Communications Coalition (FWCC) at 10; Harris Corp. at 2; i-Fi/BGI Letter; Loea at **6**; Sprint at 2; Terabeam at **6-7**; WCA at 1-2, 4.

As Loea described in its initial **comments**,¹⁰ it has successfully completed service tests with several entities, including the United States Navy and the University of Hawaii. Loea's Gigabit Ethernet test links provided these users with full duplex 1.25 Gigabits-per-second (Gbps) connectivity over distances from 2.4 to 7.4 miles, and with carrier-class service quality approaching "five nines." More recently, in another experiment, Loea provided real time video streaming (uncompressed) at the Super Bowl, enabling ABC-TV to broadcast the real-time location shots of the Qualcomm Stadium venue over a 1.485 Gbps link operating at 720P HDTV — the governing SMPTE standard for HDTV.

Loea's experimental link was the only way ABC-TV was able to provide pictures of the Qualcomm stadium in **San** Diego to its world-wide audience. The link worked flawlessly. It enabled ABC to rebroadcast the signal without any delay and without the need for expensive data compression equipment, affording ABC a tremendous cost savings.

These few examples demonstrate three key characteristics of the potential wireless broadband service market. First, the technology exists today to enable the provision of services that meet the real world requirements of customers. Second, demand for high-throughput data transmission remains extremely high. Third, users expect the same degree **of** service quality from wireless products that they presently enjoy from wireline products."

In order to meet each of these demands, the Commission should require that service providers be licensed. Notably, and almost without exception, commenters urged the Commission to forego **an** unlicensed approach for these bands. Next, the Commission should adopt a licensing regime that ensures efficient access, quality service, and ease of coordination.

¹⁰ Loea Comments at 2-4.

¹¹ *See* Loea Comments at 3-4.

Finally, the Commission should adopt the technical rules proposed herein by the industry to provide flexible, technology-neutral, and effective interference protection.

11. THE RECORD SUPPORTS ADOPTION OF THE PROPOSED ALLOCATIONS FOR THE 71-76 GHz AND 81-86 GHz BANDS

Commenters broadly support the Commission's tentative decision to adopt allocations for the 71 GHz and 81 GHz bands **as** prescribed by WRC-2000.¹² This action will maximize the utility of this spectrum for commercial use without impeding the nation's continued reliance on scientific and safety operations in these bands. To that end, Loea has suggested one additional action, the grant of co-primary status to federal operations at 75.5-76 GHz. Further, Loea has recommended the adoption of protective technical rules for the 74-76 GHz band, rather than adoption of footnote 5.561, in order to ensure that satellite operations will not incur harmful interference from forthcoming services in the UMW spectrum.

A. The Proposed Revised Allocations for the 71 GHz and 86 GHz Bands Will Ensure Ease of Coordination and Maximize Commercial Use

The Commission's proposed reallocations in the UMW spectrum received broad support among commenters. Parties agree that consolidating 71-76 GHz for fixed satellite downlinks and designating **81-86** GHz for satellite uplinks is **an** efficient way to normalize use of this spectrum.¹³

The record also supports the Commission's proposed actions with respect to radio astronomy services ("RAS").¹⁴ Deletion of the RAS allocation from the 72.77-72.91 GHz

¹² Loea Comments at 10-11; Boeing Comments at 1-2; Harris Corp. Comments at 5; Sprint Comments at 5; Cisco Comments at 7-10; FWCC Comments at 4-5.

¹³ Loea Comments at **10**, 11; Boeing Comments at 2; FWCC Comments at 4; Harris Corp. Comments at 5; Sprint Comments at 5; Cisco Comments at 7-10.

¹⁴ Loea Comments at 11; Cisco Comments at 10; FWCC Comments at 6; WCA Comments at 6-7.

frequency band is necessary to ensuring a seamless block of spectrum for satellite downlinks. Yet because this action is counterbalanced by a grant of primary status to RAS in the 81-86 GHz band, it will not diminish the amount of spectrum available to these important services, which remains the chief goal of the Caltech Owens Radio Observatory.¹⁵ That primary designation thus amply “satisfies the requirement” for RAS services, and mirrors the action taken at WRC-2000 with respect to these services.¹⁶

Finally, commenters agree that AMSAT should receive only secondary status in the **75.5-76 GHz band**.¹⁷ As WCA states, “any deletion of the amateur and AMSAT allocations from the **75.5-76 GHz** is mitigated by the fact that the nearby primary amateur and AMSAT allocation at **77.5-78 GHz** has been available for nearly four years.”¹⁸ Any perceived harm is further mitigated by the fact that only five amateur entities are using the **71-76 GHz band**.” More importantly, this change of status is necessary to ensure that commercial services over this spectrum — which must now be the Commission’s priority — have adequate protection over the entire contiguous **71-76 GHz** block. In fact, Cisco has requested that the Commission only grant even secondary status to AMSAT until **2004**, rather than **2006**, in order that “the full band should be available for fixed use no later than January 1, 2004.”²⁰ Loea believes that the Commission need not annul AMSAT’s allocation prior to **2006** if it remains a secondary user and does not cause interference with primary users in the **71-76 GHz** band.

¹⁵ Docket WT **02-146**, Comments of Caltech Owens Radio Observatory (Dec. **9,2002**).

¹⁶ *NPRM* at ¶¶ 17, 28.

¹⁷ Loea Comments at **10-11**; Boeing Comments at **2**; Cisco Comments at **7**; WCA Comments at **7**.

¹⁸ WCA Comments at **7**.

¹⁹ Loea Comments at 11 (quoting Comments of Nicholas E. Leggett, WT Docket No. **02-146**, Appendix A (Sept. **6,2002**)).

²⁰ Cisco Comments at **3**.

B. Administrative Concerns Weigh Against Adoption of Footnote 5.561 and Expansion of the Footnote Is Unnecessary and Would Be Harmful

At this time, the Commission need not adopt footnote 5.561 in order to protect federal BSS and FSS operations in the 74-76 GHz band.²¹ Interested commenters expressed a somewhat reserved approval for this proposal, for while protection of government satellite services is necessary,²² formal adoption of a footnote may have negative unintended consequences. That is, footnote 5.561 may give the government too broad a power to shut down licensees that interfere with FSS operations.²³ Loea understands that the National Telecommunications and Information Administration will file comments on this matter,²⁴ and should the Federal Government only seek a very limited right to shut down earlier licensed fixed transmitters, it will reassess its position on the adoption of this footnote.

Loea strongly opposes Boeing's proposal to expand footnote 5.561 to cover the entire 71-76 GHz band and to services other than government FSS service. While Federal users are apt to deploy earth stations selectively, private sector deployments will be almost certainly much more extensive and will cover urban areas. This will dramatically increase the value of this spectrum to fixed users. This view is shared by Cisco.²⁵

²¹ *NPRM* at ¶ 21.

²² *See* Loea Comments at 12; Boeing Comments at 5; Cisco Comments at 8 Sprint Comments at 4; Terabeam Comments at 2.

²³ Cisco Comments at 8.

²⁴ The Gallagher Letter states that "NTIA is finalizing its reply comments to the Federal Communications Commission regarding the 70-80-90 GHz Notice of Proposed Rulemaking...Our concern in the 7080 GHz bands is the protection of future federal fixed-satellite operations...To assist in the future coordination of these systems, NTIA, in coordination with the federal agencies, will develop an initial list of potential federal fixed-satellite service earth station locations."

²⁵ Cisco Comments at 9.

For these reasons, the WCA and Loea have each suggested that adoption of specific technical rules will obtain the same result — protection of government **FSS** links — without imposing unintended harmful consequences.²⁶ First, Loea proposes the adoption of power-flux density (PFD) limits of $-138 \text{ dBW/m}^2/\text{MHz}$ at 0" to 5" declination and $-138 \text{ dBW/m}^2/\text{MHz}$ at 5" to 25" declination at the earth surface, with no limits specified in this rulemaking for declination angles over 25". Second, the Commission should limit the angular elevation of fixed terrestrial services to a range of -25" to +25° from the horizon.

These rules will protect **FSS** while preserving lower-inclination sightlines for UMW terrestrial services. More importantly, these rules make clear the technical parameters that new commercial services must follow, but refrain from granting undue power to the government to shut down service on suspicion of interference. The rules that Loea and the WCA have proposed strike an important balance between protecting government operations and encouraging commercial development over the 71-76 GHz band, and therefore should be adopted in lieu of footnote 5.561.

C. Grant of Co-Primary Status to Federal Operations in the 75.5-76 GHz Will Establish a Necessary Contiguous Allocation in the 71-76 GHz Band

Loea reiterates its request that the Commission grant co-primary operations to federal users in the 75.5-76 GHz band.²⁷ Although this issue was not raised in the *NPRM*, Loea believes that this action is essential to existing and future federal government operations in this band, as it will enable them to use the entire 5 GHz block with the assurance of full interference protection.

²⁶ WCA Comments at 6; Loea Comments at 12.

²⁷ Loea Comments at 12-14.

In addition, this action would encourage development of applications with dual commercial/government utility, further maximizing use of the 71-76 GHz spectrum.

111. COMMENTERS STRONGLY SUPPORT THE PROPOSED BAND PLANS FOR THE 71-76 GHz AND 81-86 GHz BANDS

The record supports adoption of the band plans proposed in Loea's Petition.²⁸ First, commenters agree that the full broadband potential of UMW spectrum, which will approximate carrier-class fiber throughput, requires allocation of the full 5 GHz blocks at 71 GHz and 81 GHz.²⁹ Secondly, parties agree that protection of government and adjacent operations should be maintained, yet should not be onerous or cumbersome, lest the commercial development of this spectrum be stilted.³⁰

A. The UMW Spectrum Is Best Allocated in Its Full 5 GHz Blocks

The Commission's tentative proposal to grant authorization for full 5 GHz blocks at 71 and 81 GHz received broad support.³¹ The potential for UMW spectrum to substantially increase broadband availability will not be realized unless licensees obtain the full spectrum block. As Cisco commented, use of the UMW spectrum for true broadband services enables significant cost savings by obviating the need for laying terrestrial fiber: \$10 per foot for UMW deployment as opposed to \$110 per foot for fiber trenching.³² Loea has demonstrated in its tests that the transmission speeds of UMW signals today are over 1.25 Gbps per path (1.485 Gbps in the case

²⁸ See NPRM at ¶¶ 59-60.

²⁹ Loea Comments at 13-14; Boeing Comments at 3; Terabeam Comments at 3; Cisco Comments at 13; FWCC Comments at 9; Harris Corp. Comments at 5; Sprint Comments at 5; WCA Comments at 11.

³⁰ Loea Comments at 14-15; Boeing Comments at 4; Comsearch Comments at 14; Cisco Comments at 14.

³¹ Loea Comments at 13-14; Boeing Comments at 3; Terabeam Comments at 3; Cisco Comments at 13; FWCC Comments at 9; Harris Corp. Comments at 5; Sprint Comments at 5; WCA Comments at 11.

³² Cisco Comments at 3.

of the ABC-TV experimental deployment), and that speed will reach more than 10 Gbps per path in the next two years.³³ This remarkable efficiency occurs, however, only where the full 5,000 MHz are used. Channelization of the UMW bands will stifle throughput capacity, dramatically reducing the spectrum's utility.

B. Protection of Government Services and Adjacent Bands Will Be Ensured By Permitting Only Licensed Use of the UMW Spectrum In Accordance with Specific Technical Rules and Adoption of Streamlined Coordination Procedures

Over the past year, Loea has met with many representatives of the Federal Government, and it has made two presentations on the technology and spectrum requirements to the Interdepartment Radio Advisory Committee. As evidenced by the January 13, 2003, letter from Deputy Assistant Secretary Michael Gallagher, the government supports the sharing of these bands with the private sector based upon site licensing and coordination. More specifically, in regard to coordination procedures, Mr. Gallagher advises, "NTIA also looks forward to working with the private sector in the development of coordination procedures so that the spectrum resource can be used as efficiently as possible by both federal and commercial users."³⁴ Loea commits itself to working with the government, and it believes the Commission should make resolution of these coordination procedures a priority.

The Commission should protect government operations and adjacent bands with the same goal of maximizing spectrum efficiency. That is, imposing onerous coordination requirements will have the same effect on the UMW spectrum as would channelization. Although commenters acknowledge that government operations and licensees in adjacent bands must be protected from interference, the proposed means for securing this protection may unnecessarily

³³ Loea Comments at 2.

³⁴ Gallagher Letter (see Attachment 2).

impede spectrum development. For example, Comsearch finds that “[t]he current commercial/Government coordination process involves multiple unnecessary steps leading to excessive delays in licensing and **deployment**.”³⁵ For this reason, Cisco asserts that “[t]his is one of the most important issues in this proceeding, because coordination delays probably represent a bigger threat to the commercial development of the W band than actual interference problems.”³⁶ Loea suggests that its proposed coordination **framework**³⁷ can be combined with Cisco’s proposed “Trusted Path Coordinators”³⁸ to remedy this substantial concern without sacrificing the service integrity of government or adjacent operations. Loea also supports Cisco’s proposals to (1) have the Federal Government record its assignments with coordinators except those with national security implications, (2) establish a limited number of geographic zones where case-by-case coordination is required, and (3) maintain a web site that speeds coordination within those **zones**.³⁹

³⁵ Comsearch Comments at 14.

³⁶ Cisco Comments at 14 (emphasis in original).

³⁷ This framework in large part is a function of the blanket licensing regime that many parties have advocated. Nationwide licenses with individual path coordination are as useful for coordination with the government as they are for inter-carrier coordination. As Loea has described, an independent third party will create and maintain a site path database to which the government, through **NTIA**, will have ready access. The government, if it wished, could also register its own paths ensuring that all parties have perfect information about UMW transmissions nationwide. Knowing where signals are and who generates them is, most agree, the greater part of the battle in terms of avoiding interference.

³⁸ Cisco Comments at 15.

³⁹ Cisco Comments at 15, 16.

Adoption of specific technical rules for licensees will complete the protective framework. As is further explained in Loea's initial comments⁴⁰ and in Section V herein, requiring carriers to adhere to transmission requirements appropriate for this high-frequency pencil-beam technology will ensure that commercial services at 71 GHz and 81 GHz do not interfere with government operations or with adjacent bands.

IV. THE RECORD OVERWHELMINGLY SUPPORTS MANDATORY COORDINATED LICENSES THAT MAXIMIZE SERVICE QUALITY AND VALUE FOR THE CONSUMER

Commenters largely agree on a licensing regime that provides flexibility, stability, and maximum value to the consumer. They agree that licenses must be required for all UMW users in order to maintain service quality and encourage investment. Further, they agree that, due to the minimal interference concerns associated with UMW spectrum, the Commission should authorize use under blanket licenses conditioned upon site-path coordination through a third party.

Under this regime, band managers are unnecessary as a means of license administration, and therefore should not be granted exclusive or preferential access to this spectrum. Rather, the Commission should authorize the broadest possible license eligibility permitted by Congress, and should grant licenses for full 10-year terms, renewed upon showing of substantial service. There should also be a requirement that a licensee build out each path within six months of path authorization. This rule would prevent potential arbitrage within the spectrum. Each of these actions directly furthers the development of commercial services over the UMW spectrum, creating maximum value for American consumers.

⁴⁰ Loea Comments at 33-34. *See generally* Loea Comments, Attachment, "Specific Proposals for Technical Rules Governing the 71-76, 81-86, and 92-95 GHz Bands," Dr. John Lovberg ("Lovberg Paper").

A. The Commission Should Not Permit Unlicensed Commercial Use of the UMW Spectrum

Commenters agree that permitting unlicensed use of UMW spectrum will hinder, rather than encourage, its development.⁴¹ In their separate joint filing today, Loea, Cisco, Ceragon Networks, Endwave, Stratex Networks, Bridgewave, and Comsearch reiterate this position.

As Loea has explained, unlicensed use will negatively impact the use of this spectrum.⁴² First, it will degrade service quality. If anonymous unlicensed entities deploy facilities along a licensed user's service path — which may be up to 10 miles long — the likelihood that multiple transmission paths will interfere increases significantly.⁴³ To avoid concurrent paths, the licensed user would have to shorten his transmission path, requiring deployment of additional UMW equipment. The choice for Loea, or any licensed provider, thus becomes poor service quality versus diminished service rollout.

Second, unlicensed use will discourage investment in licensees. Investors will not gamble on a carrier that cannot ensure priority access to assets — in this case, spectrum authorization. In today's climate, where financing is at a premium, the telecommunications industry cannot afford to further discourage the markets from funding carriers.

Third, unlicensed use translates to anonymous use, which would preclude or significantly impede coordination among users. If the Commission does not require formal authorization and

⁴¹ Loea Comments at 16-18; Cisco Comments at iii; EDS Letter; Harris Corp. Comments at 8; NRAO Letter; CORF Comments at 8; Sprint Comments at 6; Terabeam Comments at 4, 9-10. In addition, the FWCC finds that interference between licensed and unlicensed use is likely, though it does not oppose unlicensed use “as a general matter.” FWCC Comments at 7-9. Loea notes that the Gallagher Letter states that NTIA supports using a licensing regime for this spectrum (see Attachment 2).

⁴² Loea notes that, while Comsearch initially supported unlicensed use of UMW spectrum (Comsearch Comments at 7), it has subsequently adopted the prevailing opinion that unlicensed use is not appropriate.

⁴³ As Cisco notes, unlicensed providers are less likely to deploy facilities in a workmanlike manner that will avoid interference. Cisco Comments at iii, 20-21.

coordination among paths, the ability to correct interference, which should be a simple matter, becomes complicated because users of the spectrum may not be **known**.⁴⁴ Thus, providers would remain under the threat of unresolvable harmful interference, which would degrade service levels and ultimately only deter deployment. This result is antithetical to the public interest, and yet cannot be avoided under an unlicensed use approach. The Commission should therefore impose mandatory licensing, which, as Loea has demonstrated, need not be onerous or costly.

Fourth, licensed use of the UMW spectrum will actually benefit unlicensed providers in other frequency bands. For instance, UMW links will enable gigabit backhaul from WiFi hot spots or residential deployments. Should the Commission opt for an unlicensed regime for the UMW spectrum, the risk of interference would result in significantly increased costs for deployment, likely making them uneconomic.

Fifth, the proposed site-path coordination system would facilitate coordination with Federal Government users. For example, such a construct would enable the Federal Government to preclude licensing within or between restricted areas.

For all of these reasons, a license-only approach to use of the 71 GHz and 81 GHz bands should be adopted by the Commission.

⁴⁴ See Loea Comments at 16-18; Comsearch Comments at 7; Cisco Comments at iii; **EDS** Letter; Harris Corp. Comments at **8**; NRAO Letter; CORF Comments at **8**; Sprint Comments at **6**; Terabeam Comments at 4, 9-10; FWCC Comments 9; WCA Comments at 14.

B. Coordinated Nationwide Licenses Provide the Most Flexible, Yet Secure, Framework for the UMW Spectrum

Commenters were extremely vocal in their opposition to the adoption of exclusive geographic licenses for the 71-76 GHz and 81-86 GHz bands.⁴⁵ The narrow propagation of UMW pencil beam transmissions, if coordinated properly, renders interference a minimal risk, precluding a finding that mutually exclusive licenses are necessary or proper.⁴⁶ The UMW spectrum can accommodate an almost limitless number of users in any market, negating the chief reason for imposing geographic licenses.⁴⁷ Such licensing would only increase the cost of obtaining licenses, putting UMW deployment at risk and potentially leading to delays in deployment and broadband access. Moreover, geographic licensing generally is accompanied by spectrum auctions, which is entirely inappropriate for this spectrum. By contrast, the paradigm proposed by Loea is for a three-dimensional segmentation of the spectrum, and, with such an approach, as evidenced by economist Dan Kelley's submission in Loea's **Petition**,⁴⁸ there is virtually no scarcity of spectrum at this frequency. However, given the minimal chance of interference and the economic need of potential customers to assured of no interference, path coordination is necessary.

Commenters almost uniformly advocate adoption of nationwide licenses granted by the Commission, conditioned upon path coordination through an independent third party.⁴⁹ As noted

⁴⁵ Loea Comments at 20; Boeing Comments at 5-6; FWCC Comments at 10; Harris Corp. at 10; Sprint Comments at 6; Terabeam Comments at 8; Cisco Comments at 18; Comsearch Comments at 3-4; FWCC Comments at 2; WCA Comments at 15-17.

⁴⁶ Loea Comments at 22; Terabeam Comments at 8; WCA Comments at 16.

⁴⁷ *E.g.*, ET Docket 02-135, Spectrum Task Force Report, at 38-39 (Nov. 2002).

⁴⁸ A. Daniel Kelley, HAI Consulting "Economically Efficient Licensing of the Millimeter Wave Band" (Sept. 5, 2001).

⁴⁹ Loea Comments at 16-18; Comsearch Comments at 7; Cisco Comments at iii; EDS Letter; Harris Corp. Comments at 8; NRAO Letter; CORF Comments at 8; Sprint Comments at 6; Terabeam Comments at 4, 9-10; FWCC Comments 9; WCA Comments at 14.

earlier, NTIA also supports this **approach**.⁵⁰ On a showing of service competency, the Commission would authorize an applicant to use the UMW spectrum in full **5** GHz blocks at 71 GHz or 81 GHz, or both, on the condition that the applicant register its designated transmission paths with an independent third-party **coordinator**.⁵¹ This coordinator would maintain a nationwide database that would assist in path authorization and house all location **information**.⁵² The Commission and Federal Government would have access to this information in order to provide the necessary transparency. Some parties have suggested additional roles for the coordinator, such **as** administering the renewal **process**.⁵³ The core utility of the coordinator remains, however, the authorization of UMW transmission paths on a route-by-route basis, thus ensuring interference-free use without draining Commission resources.

Individual site path licensing accomplishes for UMW spectrum what geographic licensing does for lower-frequency spectrum: increasing access to spectrum. **As** Comsearch observes, “[s]ite-by-site licensing, as opposed to geographic licensing, makes significant diversity of ownership **possible**.”⁵⁴ Where for other bands the Commission has carefully calibrated license service areas, has granted small business bidding credits, and has permitted geographic partitioning and spectrum **disaggregation**,⁵⁵ the proposed blanket license/path

⁵⁰ Gallagher Letter (see Attachment 2).

⁵¹ Licensees would submit technical specifications of their equipment as well as the coordinates of their proposed site paths. **See** Cisco Comments at 23.

⁵² Cisco has suggested several competency criteria for the coordinator. Specifically, the path coordinator must (1) maintain records on **an** accessible website within 3 business days, (2) have a “demonstrated technical expertise both with microwave or millimeter-wave radios in general” (3) be familiar with TSB 10 and Rule 101.103, and **(4)** “synchronize its coordination database nightly with every other accredited path coordinator.” Cisco at 25.

⁵³ FWCC Comments at 11.

⁵⁴ Comsearch Comments at **3-4**.

⁵⁵ **As** Loea explained in its initial comments, the Commission should not adopt geographic partitioning and spectrum disaggregation for the UMW spectrum (*NPRM* at ¶ 91),

coordination approach delivers the same result. And it does so without increasing transaction costs or artificially creating mutual exclusivity. In short, this regime comports exactly with Congress’s mandates to put spectrum into as many hands as possible.⁵⁶

Moreover, because the 71 GHz and 81 GHz bands entail virtually no technological usage limits, it is not necessary to utilize band managers or grant them exclusive or preferential access to this spectrum.⁵⁷ The Commission has recognized that band managers may not always be appropriate, and the record in this proceeding demonstrates that, for UMW spectrum, that is the case.⁵⁸ As several parties have stated, the low risk of interference in UMW spectrum precludes mutual exclusivity, and enables the Commission to award licenses through a low-cost, streamlined process.⁵⁹ Without these two factors, a band manager simply imposes “an unnecessary middleman”⁶⁰ into the licensing process, thus raising transaction costs for the actual service provider. Even more problematic, the existing band manager construct grants title to the license to the band manager, and not the service provider, rendering end user service vulnerable to the financial position of the manager. In the context of the UMW spectrum, then, band managers as presently envisioned would impede, rather than encourage, the development of services because few people would be willing to invest in networks if their use of the network is

⁵⁶ because there is no technical or — under Loea’s approach — financial barrier to accessing this spectrum. Loea Comments at 30.

⁵⁷ See 47 U.S.C. § 309(j)(3).

⁵⁸ NPRM at ¶ 80.

For example, band managers may cause additional interference, loss of spectrum efficiency and, as a result, decreased quality of service. *Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended*, WT Docket No. 99-87, Report and Order and Further Notice of Proposed Rulemaking, FCC 00-403, 15 FCC Rcd. 22709,22728,22733 (2000).

⁵⁹ Loea Comments at 26-27; Comsearch Comments at 9; Harris Corp. Comments at 9; Sprint Comments at 7; Terabeam Comments at 7.

⁶⁰ Comsearch Comments at 7.

based a *revocable* license held by a third-party over which they have no control. Loea reiterates, however, that it is not opposed to permitting license applicants to identify themselves as a band manager, for the sake of clarity, insofar as that designation does not entail special privileges or increased spectrum access.

C. License Eligibility, Term and Renewal Should Be Flexible and Ensure Maximum Value to the Consumer

The record supports the Commission’s tentative conclusions with respect to license eligibility, term and renewal.⁶¹ Permitting broad eligibility for licenses, both foreign and domestic, is necessary in this market in order to enable licensees to obtain funding from as many sources as possible,⁶² and should be granted to the extent allowed by Section 310.⁶³ In addition, commenters urge the Commission to adopt the full 10-year license term for the 71 GHz and 81 GHz bands, as that action will give stability to the nascent market, yet, because there is no technical limit on the number of licensees, will not result in “warehousing” of spectrum.⁶⁴ Construction requirements should reflect the unique site-path authorization regime that commenters support, and thus should require licensees to build out each path within 6 months of the date of approval.⁶⁵ Finally, maintenance of a license or license renewal should be contingent upon the substantial service test, which appropriately focuses on the value provided to the

⁶¹ *NPRM* at ¶¶ 74, 77, 83, 86.

⁶² Loea Comments at 22-23; Cisco Comments at 22.

⁶³ Section 310(a) provides that a “station license granted under this Act shall not be granted to or held by any foreign government,” 47 U.S.C. § 310(a), while Section 310(b) requires specific inquiry into the corporate status and structure of any “broadcast [entity] or common carrier or aeronautical en route or aeronautical fixed radio station.” 47 U.S.C. § 310(b).

⁶⁴ *See* Omnibus Budget Reconciliation Act, H.R. Rep. No. 103-111, 103rd Cong., 1st Sess. at 256 (1993) (“House Report”).

⁶⁵ Cisco suggests a slightly more aggressive 120-day buildout requirement. Cisco Comments at 22. This period is likely too short, given that licensees often encounter problems in obtaining equipment or building out a site.

consumer rather than on bare deployment figures. Thus, UMW licensees that provide “service which is sound, favorable, and substantially above a level of mediocre service which might minimally warrant renewal”⁶⁶ should be renewed.⁶⁷

Each of these rules is consistent with the Commission’s policy objective of administering the public spectrum in keeping with the public good. They maximize development, provide adequate time for deployment, and reward licensees that increase the public welfare. This framework should be the model for new spectrum allocations to come.

V. TECHNICAL RULES

A. The Commission Should Apply Part 101 to the UMW Spectrum

The record supports use of the ~~Part~~ 101 rules to regulate the UMW spectrum.⁶⁸ This section is presently applied to Fixed Microwave Services in the 24 GHz band, which supports point-to-point services much like Loea’s pencil-beam data transmissions. In addition, Comsearch notes especially that Rule 101.103 provides an instructive example for frequency coordination in these bands.⁶⁹

B. The Industry Has in Large Part Agreed on the Technical Rules for UMW Spectrum and Technologies

The record in these proceedings indicates a consensus on many of the technical rules under consideration for the UMW spectrum. In order to address what disagreement does appear, mainly with respect to UMW antenna operational parameters, the Over 40 GHz Committee of the WCA (the “Committee”), of which Loea is a member, and other entities in the industry —

⁶⁶ 47 C.F.R. § 101.1011.

⁶⁷ *See* Loea Comments at 28; Cisco Comments at 22; Terabeam Comments at 14; WCA Comments at 21; Harris Corp. Comments at 12.

⁶⁸ Loea Comments at 31; Comsearch Comments at 2, 11; Harris Corp. Comments at 12; Sprint Comments at 6; CORF Comments at 9-10.

⁶⁹ Comsearch Comments at 2, 11.

notably Cisco — have met as a group to discuss the most practical and effective solutions to these issues. As a result of those meetings, a substantial convergence on technical issues was achieved by Loea, Cisco, Ceragon Networks, Endwave, Stratex Networks, Bridgewave, and Comsearch (“Consensus Group”); these parties are also filing separate joint comments on the issues on which they reached agreement. The areas of agreement are explained in the attached supplemental paper by Dr. John Lovberg (“Lovberg Supplement”).⁷⁰ It is summarized herein, where appropriate, for the Commission’s convenience.⁷¹

1. The record demonstrates that channelization is not appropriate for the UMW spectrum and the Consensus Group supports designating the 71-76 GHz and 81-86 GHz bands as paired channels.

As several commenters have shown, the UMW spectrum is best allocated in its full 5 GHz blocks, without segmentation or channelization.⁷² Indeed, Cisco states that the “most important of the Commission’s technical service rules” should be the rejection of channelization.⁷³ Not only would channelization greatly diminish the broadband capacity of the 71 GHz and 81 GHz bands, but it is an unnecessary tool for resolving interference — UMW spectrum carries little risk of interference in the first instance. Thus, the Commission has no cause to employ spectrum channelization as it traditionally **has** done to protect Federal and adjacent band operations.⁷⁴

⁷⁰ These Reply Comments focus on resolving areas of disagreement among the parties. **For** any technical issue not addressed herein, Loea maintains its positions as articulated in its Initial Comments.

⁷¹ The WCA has authorized Loea to submit these comments. Where these comments are inconsistent with WCA’s earlier comments in this docket, these Reply Comments govern.

⁷² Loea Comments at 32-33; Cisco Comments at 27; Harris Corp. Comments at 5, 12; FWCC Comments at 9.

⁷³ Cisco Comments at 27.

⁷⁴ See *NPRM* at ¶ 97.

With regard to radio services over the UMW spectrum, Cisco has perceived the potential for interference if radios operate at full duplex within each band.⁷⁵ Acknowledging that coordination efforts alone may not resolve this problem, Cisco has proposed a simple and reliable solution: for full-duplex and other two-way radios, the 71-76 and 81-86 GHz bands will be designated as paired channels, such that transceivers operating in these bands will transmit in one channel only and receive in the other channel. This solution, which will facilitate “hub-and-spoke” deployment,⁷⁶ will ensure virtually interference-free radio transmissions without imposing hardware performance constraints that will slow innovation and deployment. The Consensus Group supports this proposal.

Loea also notes the disagreement in the record over whether to permit both frequency division duplexing (FDD) and time division duplexing (TDD),⁷⁷ or, as Cisco advocates, only TDD,⁷⁸ over the UMW spectrum. The Consensus Group asserts that an appropriate resolution to this issue is to permit only FDD in the 71 GHz and 81 GHz bands, and to allocate the 92-95 GHz band for TDD technology. The 92 GHz band is more appropriate for single-band FDD and for TDD radios, as it already requires channelization to protect cloud radar technology operating at 94.0-94.1 GHz.

2. *The Consensus Group has reached agreement on the appropriate antenna gain rules for this spectrum.*

The initial comments in this proceeding are not in consensus regarding the appropriate radiated power and antenna directionality parameters for technologies using the UMW

⁷⁵ Cisco Comments at 27.

⁷⁶ *See* Cisco Comments at 27.

⁷⁷ Harris Corp. Comments at 13.

⁷⁸ Cisco Comments at 27.

spectrum.⁷⁹ Several parties, notably Cisco,⁸⁰ have requested that the Commission adopt somewhat less stringent antenna gain requirements than Loea⁸¹ and WCA proposed.⁸² The Committee has discussed this disagreement with Cisco, and together the parties have created a revised table to govern antenna gain:

Frequency (MHz)	Cat	Max BW to 3 dB points (Included angle in degrees)	Min gain (dBi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5" to 10°*	10" to 15°*	15" to 20°*	20" to 30°*	30° 100°*	100° 140°*	140° 180°*
932.5 to 935	A B	14.0 20.0	n/a n/a	n/a n/a	6 n/a	11 6	14 10	17 13	20 15	24 20
38,600 to 40,000	A B	n/a n/a	38 38	25 20	29 24	33 28	36 32	42 35	55 36	55 36
71,000 to 76,000	A B	1.20 1.20	43‡*L ₁ 43\$	35 33	40 36	45 39	50 42	50 42	55 45	55 45
81,000 to 86,000	A B	1.20 1.20	43‡*L ₁ 43\$	35 33	40 36	45 39	50 42	50 42	55 45	55 45

‡ Antenna gain less than 50 dBi (but greater than 43 dBi) is permitted with a proportional reduction in maximum authorized EIRP in a ratio of 2 dB of power per 1 dB of gain, so that the maximum allowable EIRP (in dBW) for antennas of less than 50 dBi gain becomes $+55 - 2 (50 - G)$, where G is the antenna gain in dBi.

* For the bands 71-76 GHz and 81-86 GHz, the following specification is included for minimum radiation suppression L₁ at angles from 1.2° to 5° from centerline of main beam in dB: $L_1 = G - 28$.

Loea formally proposes this revised table, as it is confident that with the adoption of paired channel designations for 71-76 and 81-86 GHz for dual-band TDD radios only, the technical presentations by Cisco and others demonstrate that relaxing antenna gain standards will not, even in densely deployed areas, result in harmful interference among UMW users. It urges

⁷⁹ See NPRM at ¶ 100.

⁸⁰ Cisco Comments at 29-30.

⁸¹ Loea Comments at 36; Lovberg Paper at 4-5.

⁸² WCA Comments at 26-28.

the Commission to adopt this table in lieu of its earlier proposal only in conjunction with paired channel dual-band FDD restrictions. This significant relaxation of antenna standards represents a significant economic advantage, but is made possible only through the added coordination tool that dual-band FDD provides.

3. *The Consensus Group supports adoption of rules governing Automatic Transmitter Power Control*

The “hub-and-spoke” arrangement that the industry has considered, coupled with the relaxed suppression mask and power constraints that many parties support, requires the Commission to adopt rules governing Automatic Transmitter Power Control (“ATPC”).⁸³ These rules will ensure that the **risk** of interference remains minimal even with the use of wider transmission beams.

The Consensus Group has developed an ATPC proposal that will mitigate this increased **risk** of interference. It proposes that transmitters operating in the **71-76** and **81-86** GHz bands with EIRP in excess of +23 dBW must possess capability for Automatic Transmitter Power Control over a dynamic range in dB of at least the numerical value EIRP-23, with EIRP expressed in dBW. For an antenna directed at a remote cooperative receiver, the ATPC must operate to maintain the power flux density at the receiver antenna below **100 pW/cm²**, subject only to the dynamic range limitation **of** the ATPC.

⁸³ See Cisco Comments at 30-31.

4. *The Consensus Group supports a revised antenna radiation suppression mask*

Parties agree that some type of linear polarization regulation is necessary as a tool for preventing and resolving interference.⁸⁴ Cisco has proposed specific values for a cross-pol antenna radiation suppression mask. The Consensus Group has reached an agreement on the appropriate cross-polarization suppression mask:

		Minimum cross-pol radiation suppression to angle in degrees from centerline of main beam in decibels								
Frequency (MHz)	Category	0° to 1.2°	1.2° to 5°	5° to 10°*	10° to 15°*	15° to 20°*	20° to 30°*	30° to 100°*	100° to 140°*	140° to 180°*
71,000 to 76,000	A	25	25	45	50	50	55	55	55	55
76,000 to 81,000	B	25	25	43	45	45	45	45	45	45
81,000 to 86,000	A	25	25	45	50	50	55	55	55	55
86,000 to 92,000	B	25	25	43	45	45	45	45	45	45

5. *The Consensus Group has reached agreement on power spectral density for UMW antennas.*

Loea notes that it neglected to propose a power spectral density mask for antennas operating in the 71-76 GHz and 81-86 GHz bands. Having reviewed the proposals of other commenters, Loea, along with the Consensus Group, proposes that the Commission adopt a power spectral density limit of 150mW per 100MHz within both bands.

6. *The Consensus Group proposes that Rule 101.111(2)(ii) govern out-of-band emissions limits.*

In its comments, Loea has advocated adoption of the out-of-band emission limit set forth in Commission Rule 101.111(2)(ii).⁸⁵ This rule requires band-edge filtering, calculated as a

⁸⁴ Loea Comments at 36; Lovberg Paper at 14-15; Cisco Comments at 29-30; Terabeam Comments at 15-16; WCA Comments at 26-28.

⁸⁵ Loea Comments at 33-34. The Harris Corporation also suggested this approach. Harris Corp. Comments at 13.

function of transmitter power. In its comments, Cisco suggested alternative approaches related to transmitter EIRP.⁸⁶ The Consensus Group proposes that Rule 101.111(2)(ii) should be adopted without modification to govern emissions limits.

7. The Commission should adopt requirements for coordination and use restrictions to protect RAS services.

Some parties expressed concerns that additional measures are necessary to protect RAS operations over UMW spectrum.⁸⁷ Specifically, the NRAO states that a larger coordination radius of 60 km should be adopted for ten Very Long Baseline Array Stations "for adequate path attenuation in [these] frequency bands."'' The Consensus Group agrees that this increased protection is warranted, and supports adoption of a modified footnote USzzz as follows:⁸⁹

USzzz In the bands 81-86 GHz, 92-94 GHz, and 94.1-95 GHz, the radio astronomy service shall not receive protection from other allocated services, except within the maximum coordination distances listed for the following radio astronomy observatories, when such coordination zones lay outside of the one hundred most populous urbanized areas as defined by the U.S. Census Bureau.

Telescope and site	150 kilometer (93 mile) radius centered on:	
	North Latitude	West Longitude
National Radio Astronomy Observatory (NRAO), Robert C. Byrd Telescope, Green Bank, WV	38° 25' 59"	79° 50' 24"
NRAO, Very Large Array, Socorro, NM	34° 04' 44"	107° 37' 06"
University of Arizona 12-m Telescope, Kitt Peak, AZ	31° 57' 10"	111° 36' 50"
BIMA Telescope, Hat Creek, CA	40° 49' 04"	121° 28' 24"
Caltech Telescope, Owens Valley, CA	37° 13' 54"	118° 17' 36"
Five Colleges Observatory, Amherst, MA	42° 23' 33"	72° 20' 40"
Haystack Observatory, Westford, MA	42° 37' 23"	71° 29' 19"
James Clerk Maxwell Telescope, Mauna Kea, HI	19° 49' 33"	155° 28' 20"
NRAO, Very Long Baseline Array Stations	60 kilometer (37 mile) radius centered on:	
Brewster, WA	48° 07' 52"	119° 41' 00"
Fort Davis, TX	30° 38' 06"	103° 56' 41"

⁸⁶ Cisco Comments at 31.

⁸⁷ NRAO Letter at 2; Cisco Comments at 10-11, 32-33.

⁸⁸ NRAO Letter at 2.

⁸⁹ This footnote represents a slight modification to the Commission proposed footnote in Appendix A to the NPRM.

Hancock, NH	42° 56' 01"	71° 59' 12"
Kit Peak, AZ	31° 57' 23"	111° 36' 45"
Los Alamos, NM	35° 46' 31"	106° 14' 44"
Mauna Kea, HI	19° 48' 05"	155° 27' 19"
North Liberty, IA	41° 46' 17"	91° 34' 27"
Owens Valley, CA	37° 13' 54"	118° 16' 37"
Pie Town, NM	34° 18' 04"	108° 07' 09"
Saint Croix, VI	17° 45' 24"	64° 35' 01"

Secondly, Cisco has suggested that the Commission permit only digital modulation in the 71 GHz and 81 GHz bands in order to "make harmful interference to RAS less likely."⁹⁰ The Consensus Group recognizes that this requirement will facilitate coordination with RAS services. It therefore proposes the following rule:

Within the 150km coordination radii around Radio Astronomy Observatories and the 60 km coordination radii around Very Long Baseline Array Observatories listed under footnote USzzz, the Coordinator may restrict operations in the 71-76 and 81-86 GHz bands to scrambled digital modulation schemes.

VI. COMMENTERS AGREE THAT THE 71-76 GHz AND 81-86 GHz BANDS SHOULD NOT BE SUBJECT TO AN AUCTION

Competitive bidding is both unnecessary and counterproductive for the UMW spectrum."⁹¹ **First**, as several parties have emphasized, the development of this new commercial spectrum in part depends on maintaining low costs of entry.⁹² Subjecting spectrum to auction immediately raises the cost of service by orders of magnitude, which "shifts licensees' motivation from providing service to recovering investment."⁹³ As such, auctions "tend to limit the majority of holdings into a small subset,"⁹⁴ rendering them a "highly inefficient" method of

⁹⁰ Cisco Comments at 33.

⁹¹ *See NPRM* at ¶ 107.

⁹² Loea Comments at 9; EDS Letter; i-Fi/BGI Letter; FWCC Comments at 10; Harris Corp. Comments at 2.

⁹³ FWCC Comments at 10.

⁹⁴ Harris Corp. Comments at 2.

authorizing spectrum.⁹⁵ Auctioning UMW licenses is therefore wholly antithetical to Congress's⁹⁶ and the Commission's⁹⁷ spectrum policy requiring the widest possible and most efficient dissemination of licenses.

Second, competitive bidding would run counter to the constraints of Section 309. That is, auctions are permissible only where spectrum requires mutual exclusivity,⁹⁸ which is demonstrably not the case for the UMW spectrum. The unique propagation behavior of the UMW spectrum renders interference negligible, obviating all notions of mutual exclusivity.⁹⁹ Thus, as a matter of statutory proscription, the Commission may not anticipate the need for exclusive licenses and competitive bidding where, as here, none is technologically required. Moreover, because the technical parameters of UMW technologies render it such an open wireless medium, multiple entities may use it in any given market; the Commission therefore does not need to resort to auctioning licenses in order to limit entry, and thus interference. The UMW spectrum in itself eliminates the risk of interference without regulatory intervention.

⁹⁵ FWCC Comments at 10.

⁹⁶ *House Report* at 576, 573. *See also* 47 U.S.C. § 309(j)(4) (requiring the Commission to establish bidding mechanisms that “promote an equitable distribution of licenses and services among geographic areas, [and] economic opportunity for a wide variety of applicants, including small businesses”).

⁹⁷ *Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service*, GN Docket No. 96-228, Report and Order, FCC 97-250, 12 FCC Rcd. 10785, 10829 (1997) (stating that “opening the [wireless communications system] market to a wide range of applicants will permit and encourage entrepreneurial efforts to develop new technologies and services”).

⁹⁸ Section 309(j) requires the Commission “to use engineering solutions, negotiation, threshold qualifications, service regulations, and other means in order to avoid mutual exclusivity in application and licensing proceedings.” 47 U.S.C. § 309(j)(6)(E).

⁹⁹ Loea Comments at 37; FWCC Comments at 2, 10.

CONCLUSION

For these reasons, the Commission should take the following actions for the allocation and governance of the **71-76** GHz and **81-86** GHz bands, the UMW spectrum:

- Adopt the proposed **FSS** and **MSS** uplink and downlink consolidation in these bands;
- Delete the RAS allocation from the **72.77-72.91** GHz band;
- Adopt technical rules to protect satellite operations in the **74-76** GHz band rather than adoption of a formal footnote. These rules should be in the form of PFD limits of - **138** dBW/m²/MHz at 0" to 5" declination and at 5" to 25" declination at the earth surface;
- Grant co-primary status to Federal operations in the **75.5-76** GHz band in order to create a uniform Federal-commercial co-primary allocation throughout the **71-76** GHz band;
- Grant authorizations for the UMW spectrum in their full 5 GHz blocks;
- Require full authorization for all UMW users;
- Authorize UMW usage on a nationwide basis, rather than by geographic area;
- Permit the maximum licensee eligibility permitted under Section **310** of the Act;
- Establish path coordinators for the nationwide UMW licenses, and not band managers that may hinder service growth;
- Grant 10-year UMW licenses with a renewal expectancy requiring individual transmission path build-out within **6** months of path authorization;
- Forbear from applying historical Title II regulations on UMW users contained in Sections **201, 202, 203, 204, 205, 211** and **212**;
- Hold that UMW spectrum shall not be subject to competitive bidding or mutual exclusivity due to the unique propagation characteristics of this spectrum that permits virtually unlimited users in any given market;
- Adopt the technical rules proposed in these Reply Comments, which will encourage broad development of equipment and services for the UMW spectrum.

Respectfully submitted,

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ATTACHMENT 1

Supplemental Paper

Dr. John Lovberg

**SPECIFIC PROPOSALS FOR TECHNICAL RULES
GOVERNING THE
71-76, 81-86 AND 92-95 GHZ BANDS**

SUPPLEMENTAL PAPER

**DR. JOHN LOVBERG
CTO, LOEA COMMUNICATIONS CORPORATION**

JANUARY 31, 2003

Introduction

In their comments to NPRM-02-180A regarding rulemaking in the 71-76, 81-86, and 92-95 GHz bands, respondents Boeing and the National Radio Astronomy Observatory (NRAO) focused primarily on protections to satellite and radio-astronomy applications, while all other respondents made specific technical recommendations for fixed point-to-point uses of the bands. Within the latter group, there was unanimous consensus on several points regarding rulemaking, namely:

- No spectral segmentation of the 71-76 and 81-86 GHz bands and only minimal segmentation of the 92-95 GHz band as necessary to protect the 94.0-94.1 GHz cloud radar band
- No band managers and no geographic-area licensing of spectrum based on auctions
- Use of point-to-point licensing (opinions varied on authorizing a non-licensed underlay)
- Narrow-beam restriction on physical extent of radiation pattern (opinions varied on the precise envelope definition)

Within the same group, however, each respondent proposed one or more specific rule recommendations differing from the recommendations proposed in the WCA filing, which had represented a first attempt to attain a consensus of fixed-service users. The areas of difference comprised:

- Transmitter power limits versus antenna gain and radiation suppression mask
- Regulating the use of Adaptive Transmitter Power Control (ATPC)
- Allowing full-duplex transmission within a band
- Out-of-band emissions levels requirements
- Analog modulation restrictions
- Required accuracy of end-point location in license filing

Section 1 Managing Interference

The propagation characteristics of the frequencies covered in this NPRM allow a new paradigm for managing interference – one based upon geographical, rather than spectral parceling, but one which also offers nearly unlimited reuse of spectrum such that wide-area spectrum auctions are not necessary or warranted.

In general, there are two ways to coordinate spectrum for maximum reuse: the first involves placing strict limits on the extent of the radiation envelope emitted from an antenna, while the second involves limiting the spectral content of the radiated energy. In its original petition, Loea proposed a set of technical rules which relied entirely on the first means of coordination; this proposal advocated very high antenna gain minima, and extreme limits to off-axis radiation suppression. In return, the proposal allowed complete flexibility in spectrum use, thereby minimally restricting potential for future growth of new spectrum applications. Several respondents to the NPRM pointed out the practical

difficulties of attaining such performance from practical antennas, and suggested alternate proposals relaxing constraints on gain and off-axis suppression.

1.1 Dual Band FDD vs. Single-Band FDD or TDD One very interesting proposal advanced by Cisco balances the two means for spectrum coordination, advocating some relaxation of the gain and suppression requirements at the expense of restricting radiation within a beam to a single propagation direction in each of the 71-76 and 81-86 GHz bands. This proposal would leave the 92-95 GHz band open for full-duplex applications such as single-band Frequency Division Duplexed (FDD) or Time Division Duplexed (TDD) radios. Under Cisco's proposal, each building or tower acting as a wireless node would be assigned an "East" or "West" designation. All radios originating from a building or tower with a specific designation (e.g., "East") would operate as outgoing half-duplex in one band (e.g., 71-76 GHz), and incoming half-duplex in the other (81-86 GHz). This "paired channel" assignment, as used generally across ~~Part~~ 101 licensed bands, provides a spectrum coordinator with a useful tool for managing hub-and-spoke deployments, and at the same time relaxes constraints on radiation suppression masks for large off-axis angles.

Harris Corporation has expressed the desire to preserve spectrum for TDD radio deployment. The 92-95 GHz band, which requires protection for cloud radar at 94.0-94.1 GHz, ideally accommodates such technology.

The following proposal would mitigate interference without undue hardware performance constraints that could otherwise preclude cost-effective deployment of technology in the 71-76 and 81-86 GHz bands:

For full-duplex and other two-way radios, the 71-76 and 81-86 GHz bands will be designated as paired channels, such that transceivers operating in these bands will transmit in one channel only and receive in the other channel.

1.2 ATPC An immediate consequence of pairing the 71-76 and 81-86 GHz bands and authorizing only dual-band FDD radios in the bands is that in hub-and-spoke deployments, all of the beams incident on a specific tower or building will reside within a single spectral band. In lieu of invoking spectral segmentation, an option which is unanimously and strongly opposed by all NPRM respondents, the only means of managing interference in these cases will involve restricting the power and the physical extent of the incident beams. However, in their NPRM comments, Cisco and Terabeam have proposed *relaxation* of the near-in suppression mask relative to Loea's proposal, and Cisco, Terabeam, Comsearch, and the Fixed Wireless Communications Coalition have each proposed relaxation of proposed power penalties for wider antenna beams, all as a means of mitigating hardware and installation costs. If such accommodations are to be made permitting enlargement of the physical envelope of the radiation pattern, then the use of incident power management is elevated from a simple matter of good design practice to a critical requirement for coordinating hub-and-spoke deployments.

Several options have been proposed for mandating ATPC; one common proposal is based upon the TSB-10 formalism defining carrier-to-noise ratios (C/N) required for error-free operation with different modulation schemes, and an appropriate overhead for setting ATPC levels. Unfortunately, TSB-10 is more relevant to multi-path fading than to rain fade at MMW frequencies. In addition, this form of regulation does not reward users for developing power-efficient and spatially efficient radios. An alternative proposal, more appropriate to this end, sets a limit on the absolute power flux density (PFD) originating from a specific transmitter as measured at the location of its associated receiver antenna. A maximum authorized PFD of 100 pW/cm^2 provides a 10 dB cushion above the required C/N level for 10^{-10} BER with an 8PSK receiver with an 8-dB noise figure, using a 1-foot dish antenna.

A radio using ATPC will operate at minimum output power in good weather and at maximum power during heavy rain events that define its availability threshold. For “four nines” performance in extreme U.S. rain zones such as the Gulf Coast, operating through this range of weather conditions demands a dynamic range in output power of up to 45 dB. Preserving a 13-dB cushion for clear-weather operation, a receiver operating at maximum EIRP must accommodate 32 dB of ATPC dynamic range. A receiver operating at lower maximum power needs correspondingly less ATPC range to operate within clear-weather power limits, consequently the appropriate requirement on ATPC dynamic range (in dB) is $32 - \{55 - \text{EIRP}_{[\text{dBW}]}\}$, or $\text{EIRP}_{[\text{dBW}]} - 23$. For radios with EIRP below +23 dBW, no ATPC should be required.

The following proposal works hand-in-hand with the dual-band FDD proposal to enable effective coordination, even in dense hub-and-spoke deployments, without unduly constraining hardware to impractical performance levels or costly implementations:

Transmitters operating in the 71-76 and 81-86 GHz bands with EIRP in excess of +23 dBW must possess capability for Adaptive Transmitter Power Control over a dynamic range in dB of at least the numerical value $\text{EIRP} - 23$, with EIRP expressed in dBW. When pointed at a remote cooperative receiver, the ATPC must operate to maintain the power flux density at the receiver antenna below 100 pW/cm^2 , subject only to the dynamic range limitation of the ATPC.

1.3 Antenna Gain and Radiation Suppression Mask As a further consequence of mandating dual band FDD along with ATPC, the strict limits proposed in Loea’s petition and the subsequent WCA response to the NPRM may be relaxed somewhat without significant compromise to spectrum reuse. Loea had proposed a minimum antenna gain requirement of 50 dBi, with a waiver for lower gain antennas at an EIRP power penalty of 3 dB per dB of reduced antenna gain, relative to a +55 dBW EIRP. After considering the opinions of several NPRM respondents relative to the need for such stringent penalties, Loea acknowledges that with a fixed mask for radiation suppression at angles greater than 5 degrees off axis, an EIRP power penalty of only 2 dB per dB of reduced antenna gain will provide sufficient isolation for dense deployments.

Radiation suppression requirements are most stringently dictated by coordination requirements for hub-and-spoke deployments. ATPC mandates would ease required suppression levels relative to Loea's original proposal. With these proposed ATPC regulations specifying a maximum incident PFD level at a hub, an absolute interference sensitivity threshold is effectively defined for the receiver. The proposed PFD limit of $100\text{pW}/\text{cm}^2$ is about 33 dB above a typical receiver noise floor, so a suppression limit of 35 dB at 5 degrees off-axis should allow spoke-beam angular separations as small as 5 degrees at a hub.

Likewise, mandating unidirectional transmission in the 71-76 and 81-86GHz bands allows channel coordination such that front-to-side ratios can be relaxed to a more practical level without creating large exclusion zones around transmitters. A relaxed FSR level of 50 dBc is proposed in conjunction with the proposed band-use restriction.

Existing Part 101 suppression masks do not limit radiation levels within 5 degrees of the main beam centerline. The higher antenna directivity mandates proposed for this band enable and indeed necessitate such limits to provide for maximum re-use of the spectrum. For angles less than 5 degrees, setting as constant the product of receiver antenna gain and relative off-axis suppression required, i.e., trading off suppression and antenna gain at -1 dBc per +1 dBi, effectively fixes the receiver off-axis sensitivity level for equitable coordination of random deployments. The lower limit of the first off-axis angular bin must exclude the main beam; a limit of 1.2 degrees is proposed consistently with a hard limit on minimum authorized antenna gain of 43 dBi. Simulations of random deployments indicate a rapid increase in incidents of interference for $L_1 > G - 28$, where L_1 is the minimum radiation suppression in dBc and G is the antenna gain in dBi.

These considerations lead to the following revised proposal for the Part 101 Antenna Standards table:

Frequency (MHz)	Cat	Max BW to 3 dB points (Included angle in degrees)	Min gain (dBi)	Minimum radiation suppression to angle in degrees from centerline of main beam in decibels						
				5" to 10°*	10" to 15°*	15" to 20°*	20" to 30°*	30" to 100°*	100° to 140°*	140° to 180°*
932.5 to 935	A	14.0	n/a	n/a	6	11	14	17	20	24
	B	20.0	n/a	n/a	n/a	6	10	13	15	20
...										
...										
38,600 to 40,000	A	n/a	38	25	29	33	36	42	55	55
	B	n/a	38	20	24	28	32	35	36	36
71,000 to 76,000	A	1.20	43‡* L_1	35	40	45	50	50	55	55
	B	1.20	43\$	33	36	39	42	42	45	45
81,000 to 86,000	A	1.20	43‡* L_1	35	40	45	50	50	55	55
	B	1.20	43\$	33	36	39	42	42	45	45

‡ Antenna gain less than 50 dBi (but greater than 43 dBi) is permitted with a proportional reduction in maximum authorized EIRP in a ratio of 2 dB of power

per 1 dB of gain, so that the maximum allowable EIRP (in dBW) for antennas of less than 50 dBi gain becomes $+55 - 2 (50 - G)$, where G is the antenna gain in dBi.

* For the bands 71-76 GHz and 81-86 GHz, the following specification is included for minimum radiation suppression L_1 at angles from 1.2° to 5" from centerline of main beam in dB: $L_1 = G - 28$.

Note that relaxation of the tight technical specifications on Antenna Standards proposed earlier by Loea is enabled only by adoption of new regulations mandating ATPC and allowing unidirectional transmission within each of the 71-76 and 81-86 GHz bands. If proposals for either or both of these new regulations are not adopted, the necessity for the more restrictive Antenna Standards proposed in Loea's earlier Petition and Reply Comments remains.

1.4 Cross-Polarized Antenna Radiation Suppression Mask Loea has proposed that linear polarization should be mandated for operations in the 71-76 and 81-86 GHz bands to provide an additional tool for band-use coordination. In its comments on the NPRM, Cisco went further to propose a cross-pol suppression mask for antennas operating in the 71-76 and 81-86 GHz spectral bands. Loea has reviewed Cisco's comments, and supports the following similar proposal specifying cross-pol radiation limits:

		Minimum cross-pol radiation suppression to angle in degrees from centerline of main beam in decibels								
Frequency (MHz)	Category	0" to 1.2"	1.2" to 5"	5° to 10°*	10° to 15°*	15° to 20°*	20° to 30°*	30° to 100°*	100° to 140°*	140° to 180°*
71,000 to 76,000	A	25	25	45	50	50	55	55	55	55
	B	25	25	43	45	45	45	45	45	45
81,000 to 86,000	A	25	25	45	50	50	55	55	55	55
	B	25	25	43	45	45	45	45	45	45

1.5 In-Band Power Spectral Density Loea's original Petition proposed an EIRP limit of +55 dBW for antennas with gain of 50 dBi or higher, but through oversight neglected to specify limits on power spectral density within the subject bands. Loea's petition sets the maximum output power from a fixed point-to-point radio transmitter to 3 Watts; uniformly distributed across the 5 GHz channel, this represents a power spectral density of 60 mW/100 MHz. To account for natural inhomogeneity in modulation spectra and inevitable amplifier gain variation across the authorized band, the slightly higher power spectral density limit of 150mW/100 MHz is proposed:

Transmissions in the 71-76 and 81-86 GHz bands shall be subject to a maximum power spectral density limit of 150 mW per 100 MHz.

1.6 RAS Protection In its reply to the NRPM, the NRAO proposed increasing the coordination radius around 10 Very Long Baseline Array Stations from 25 km to 60 km. The NRAO has provided well-founded technical arguments to support this proposal.

Understanding the importance of the broad 81-95 GHz spectral continuum to scientific research, Loea supports the NRAO proposal, subject again to the FCC's proposal to limit RAS protection in these bands to areas outside of the one hundred most populous urbanized areas as defined by the U.S. Census Bureau. As proposed, the new footnote would read:

USzzz In the bands 81-86GHz, 92-94 GHz, and 94.1-95 GHz, the radio astronomy service shall not receive protection from other allocated services, except within the maximum coordination distances listed for the following radio astronomy observatories, when said observatories fall outside of the one-hundred most populous urbanized areas as defined by the U.S. Census Bureau.

Telescope and site	150 kilometer (93 mile) radius centered on:	
	North Latitude	West Longitude
National Radio Astronomy Observatory (NRAO), Robert C. Byrd Telescope, Green Bank, WV	38° 25' 59"	79° 50' 24"
NRAO, Very Large Array, Socorro, NM	34° 04' 44"	107° 37' 06"
University of Arizona 12-m Telescope, Kitt Peak, AZ	31° 57' 10"	111° 36' 50"
BIMA Telescope, Hat Creek, CA	40° 49' 04"	121° 28' 24"
Caltech Telescope, Owens Valley, CA	37° 13' 54"	118° 17' 36"
Five Colleges Observatory, Amherst, MA	42° 23' 33"	72° 20' 40"
Haystack Observatory, Westford, MA	42° 37' 23"	71° 29' 19"
James Clerk Maxwell Telescope, Mauna Kea, HI	19° 49' 33"	155° 28' 20"
NRAO, Very Long Baseline Array Stations	60 kilometer (37 mile) radius centered on:	
	North Latitude	West Longitude
Brewster, WA	48° 07' 52"	119° 41' 00"
Fort Davis, TX	30° 38' 06"	103° 56' 41"
Hancock, NH	42° 56' 01"	71° 59' 12"
Kitt Peak, AZ	31° 57' 23"	111° 36' 45"
Los Alamos, NM	35° 46' 31"	106° 14' 44"
Mauna Kea, HI	19° 48' 05"	155° 27' 19"
North Liberty, IA	41° 46' 17"	91° 34' 27"
Owens Valley, CA	37° 13' 54"	118° 16' 37"
Pie Town, NM	34° 18' 04"	108° 07' 09"
Saint Croix, VI	17° 45' 24"	64° 35' 01"

1.7 Unlicensed Uses It will not be possible for a spectrum coordinator to effectively coordinate the subject bands given the coexistence of unlicensed operations in the band. In addition, the 57-64 GHz band already comprises sufficient bandwidth for unlicensed multi-gigabit applications. For these reasons, the following provision is proposed:

No unlicensed operations shall be allowed in the 71-76 and 81-86 GHz bands.

1.8 Satellite Coordination Loea has proposed coordination with future satellite operations based upon path elevation; in essence, horizontal and near-horizontal paths are reserved for fixed services while more elevated paths are reserved for future satellite uses. The satellite community has not developed specific parameters for downlinks in the

71-76 GHz spectrum or uplinks in the 81-86 GHz spectrum, but requests primary protection status for future undefined applications in both bands.

Broadband geostationary satellite applications will not be practical in these bands until reliable MMW sources of 100 Watts or more become available, and even then only in clear weather and not at low inclination angles near the Earth's poles. Broadband LEO applications with 10 Watt transmit levels could accommodate significant rain events (to about 15 mm/hr) at near-zenith angles, but almost no rain (< 3 mm/hr) for inclination angles below 25 degrees. Narrowband satellite applications are accommodated more robustly in lower frequency bands that are already in use.

For these reasons, and considering the significant present-day potential in the fixed services for providing high-capacity connectivity to the general populace, the PFD restrictions previously proposed by Loea for satellite operations at low-inclined paths are appropriate. Considering the restrictions on fixed-service horizontal path elevations that have already been proposed to protect satellite services, a more general primary protection footnote for undefined future satellite operations is entirely inappropriate.

ATTACHMENT 2

**Letter from Michael Gallagher, NTIA,
to Louis Slaughter, Loea Communications Corporation**



UNITED STATES DEPARTMENT OF COMMERCE
National Telecommunications and
Information Administration
Washington, D.C. 20230

JAN 13 2003

Mr. Louis S. Slaughter
President and Chief Executive Officer
Loea Corporation
3038 Aukele Street
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Dear Mr. Slaughter:

It was a pleasure meeting with you, and I appreciate the briefings that Loea staff have presented to the Interdepartment Radio Advisory Committee (IRAC) regarding the technology and applications for broadband radio communications in the bands above 71 GHz. NTIA supports the introduction of commercial services in the **71-76,81-86**, and **92-95** GHz frequency bands. Although there are a variety of federal systems that are either operational or planned for each of these bands, NTIA believes that the Federal Government also has requirements for broadband communications that commercial vendors may be able to provide.

NTIA is finalizing its reply comments to the Federal Communications Commission regarding the **70-80-90** GHz Notice of Proposed Rulemaking. NTIA generally supports full sharing of these bands with commercial users using site licensing and coordination. Our concern in the **70-80** GHz bands is the protection of future federal fixed-satellite operations. Some of these space systems have already been advanced published with the International Telecommunication Union, but will not become operational until after many terrestrial systems have been deployed. To assist in the future coordination of these systems, NTIA, in coordination with the federal agencies, will develop an initial list of potential federal fixed-satellite service earth station locations.

NTIA also looks forward to working with the private sector in the development of coordination procedures so that the spectrum resource can be used as efficiently as possible by both federal and commercial users.

Sincerely,

Michael D. Gallagher
Deputy Assistant Secretary
for Communications and Information

CERTIFICATE OF SERVICE

I, Stephanie A. Joyce, certify that on this 3rd day of February, **2003**, a true and correct copy of the foregoing Reply Comments of Loea Communications Corporation, Inc. were served First Class Mail* or electronic mail on the following persons:



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